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Wilson

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(54) **DEVICE AND METHOD FOR COLLECTION OF MATERIAL FROM A SURFACE**

(76) Inventor: **Graham J. Wilson**, Merseyside (GB)

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E01H 1/12 (2006.01)

(52) **U.S. Cl.**
CPC ***E01H 1/1206*** (2013.01); *E01H 2001/1293* (2013.01)
USPC **294/1.3**; 294/1.4

(58) **Field of Classification Search**
CPC E01H 1/1206; E01H 2001/1293
USPC 294/1.3, 1.4, 86.4, 100
See application file for complete search history.

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(57) **ABSTRACT**

The invention provides a device (**10**, **210**, **510**) for collecting material from a surface. The device is particularly but not necessarily exclusively suited to collection of animal excreta, it has a jaw arrangement (**22**, **224**, **524**) which is able to be opened to define a mouth (**28**) for receiving the material to be collected, and to be closed to collect the material. A conveyor mechanism (**44**, **46**, **364**) is provided for advancing collected material into a housing (**12**, **512**). A liner (**33**) is placed over the jaw arrangement to separate it from the material being collected. The conveyor mechanism serves to advance the liner along with the material collected therein, whereby the material is able to be collected into the housing and retained in the liner without making contact with surfaces of the device.

17 Claims, 15 Drawing Sheets

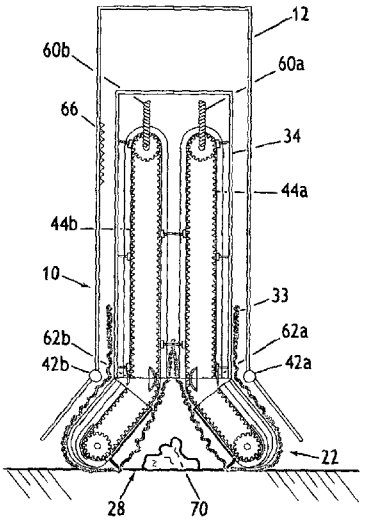


FIGURE 1a

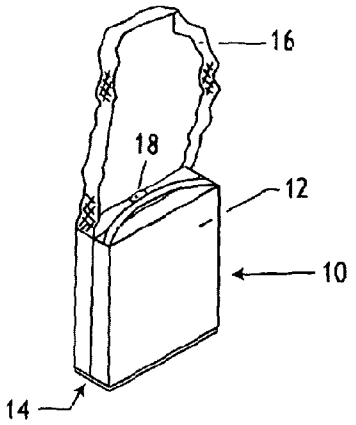


FIGURE 1b

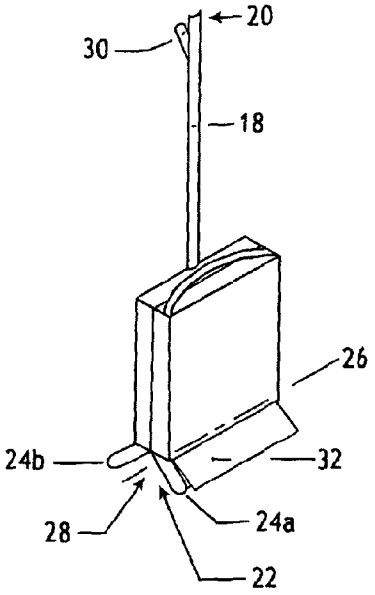


FIGURE 1c

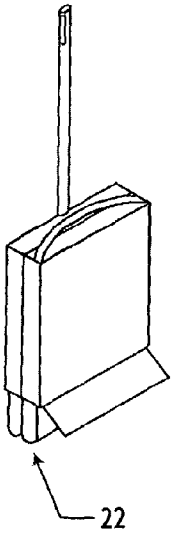


FIGURE 1d

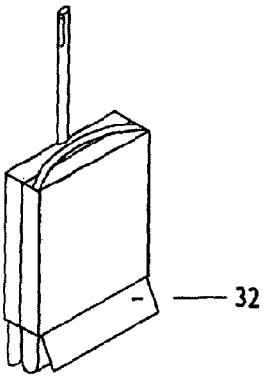


FIGURE 1e

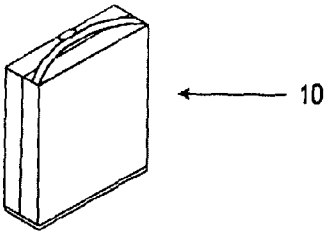


FIGURE 2a

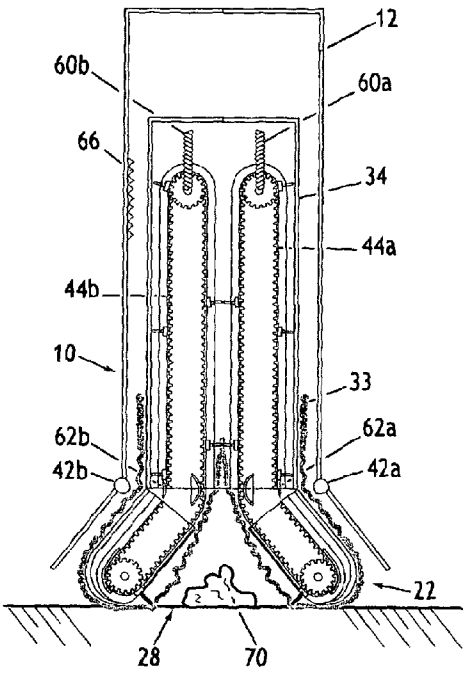


FIGURE 2b

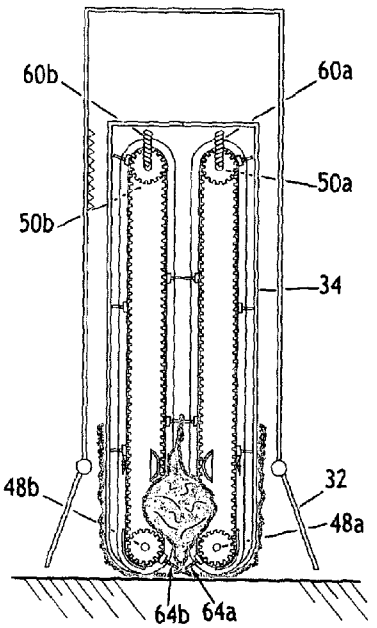
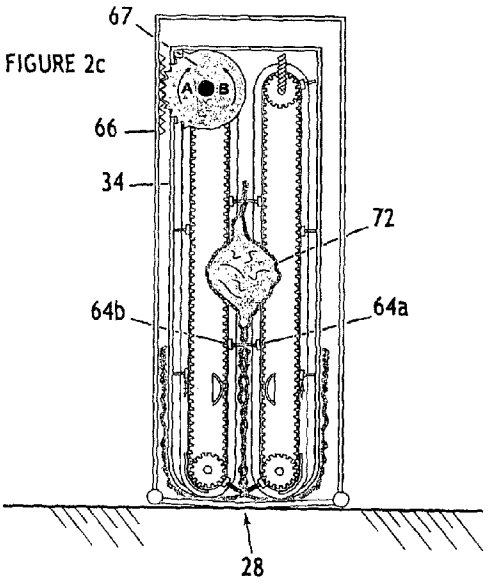


FIGURE 2c



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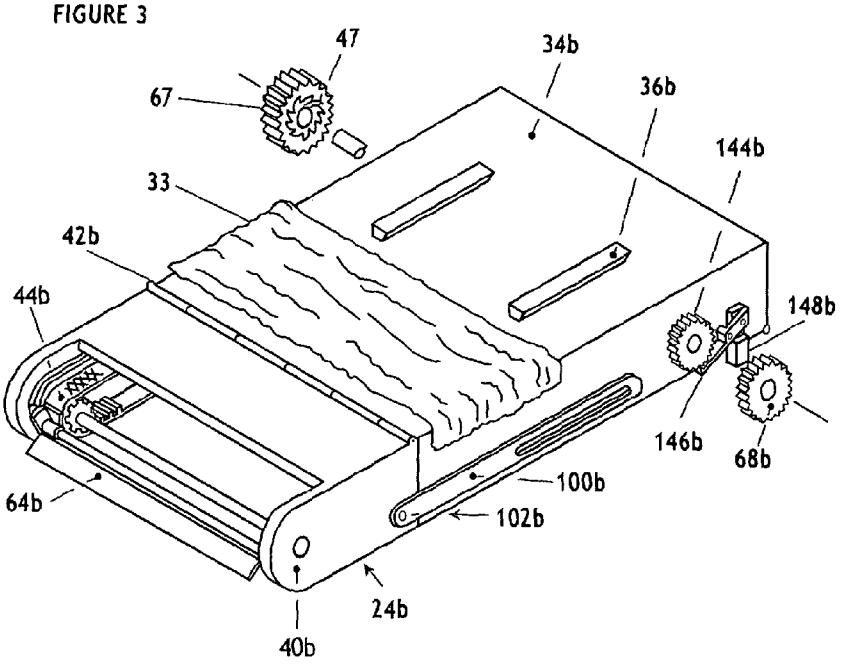
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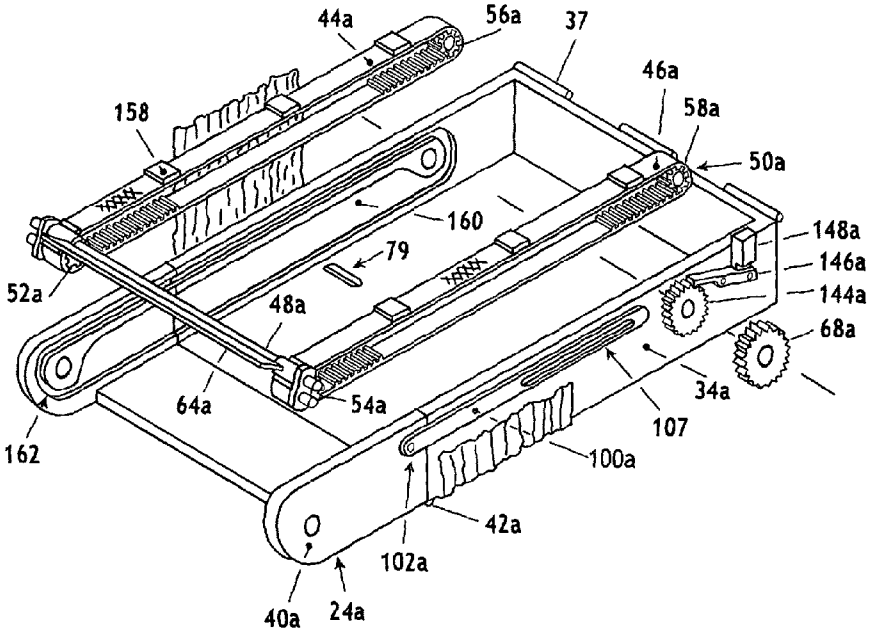
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FIGURE 4

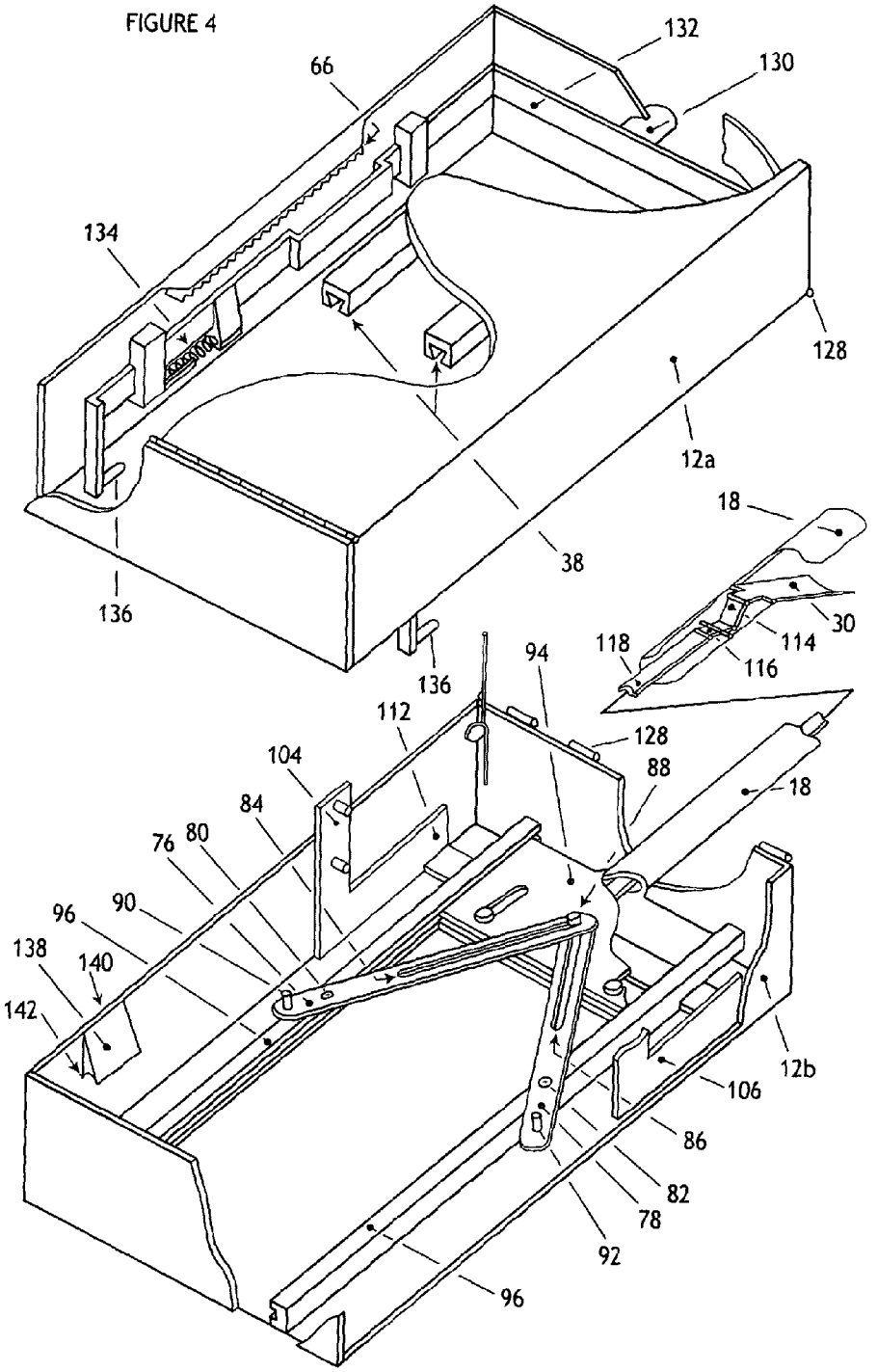
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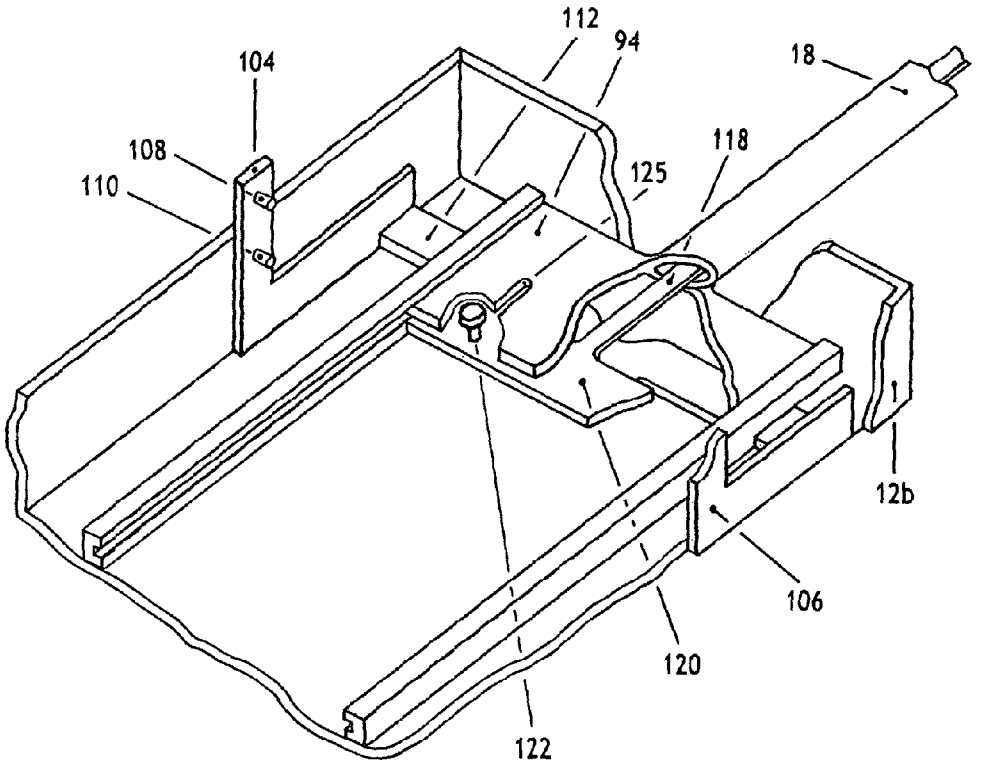
FIGURE 5



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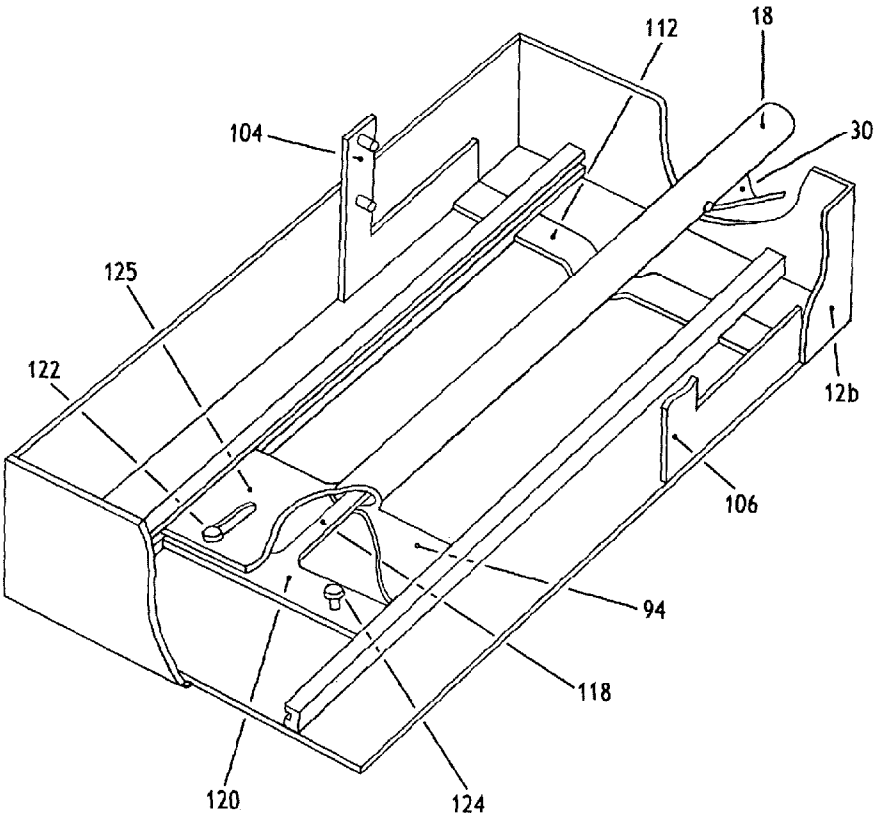


FIGURE 7a

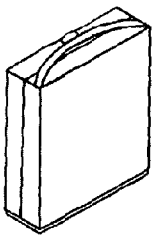


FIGURE 7b

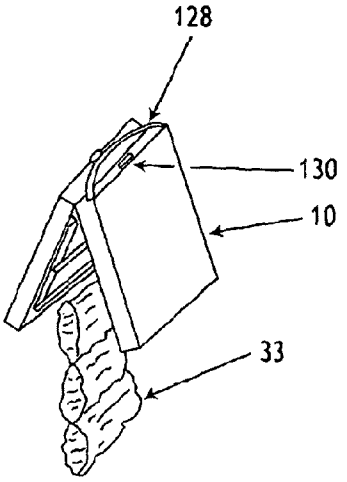


FIGURE 8

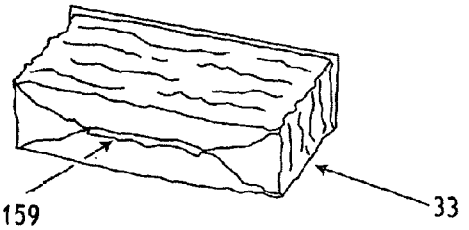
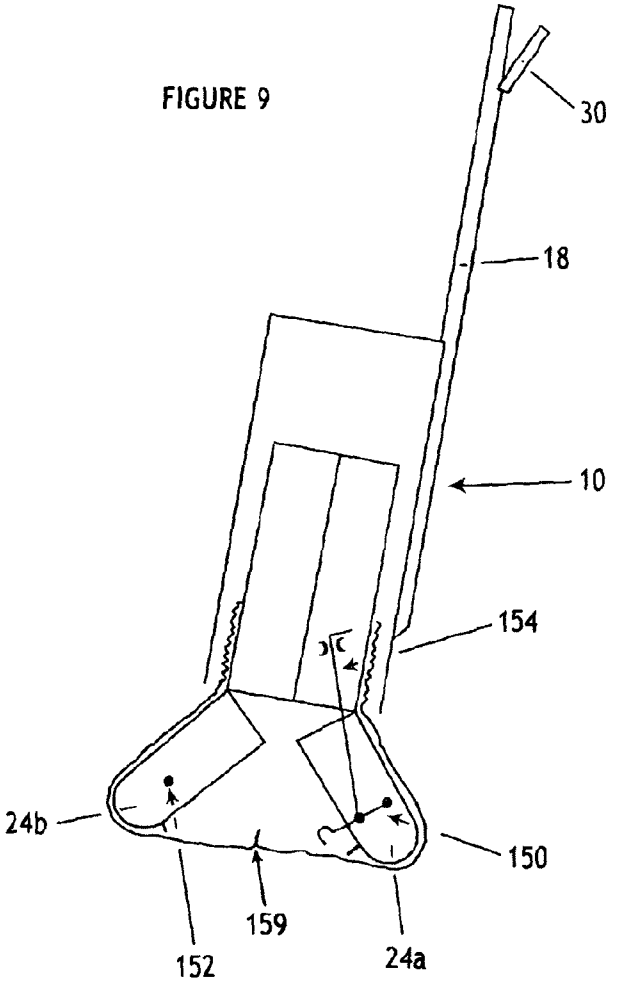


FIGURE 9



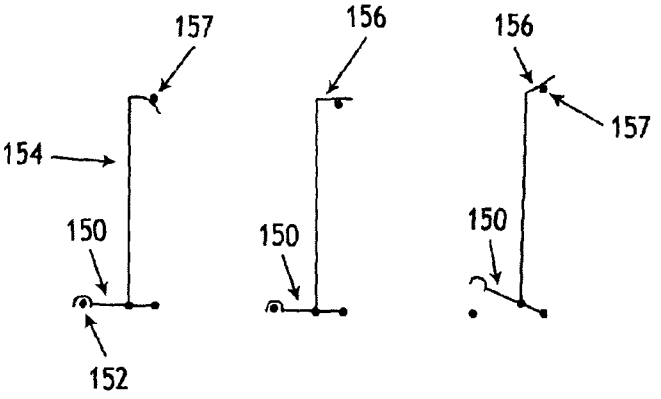


FIG 10a FIG 10b FIG 10c

FIGURE 11

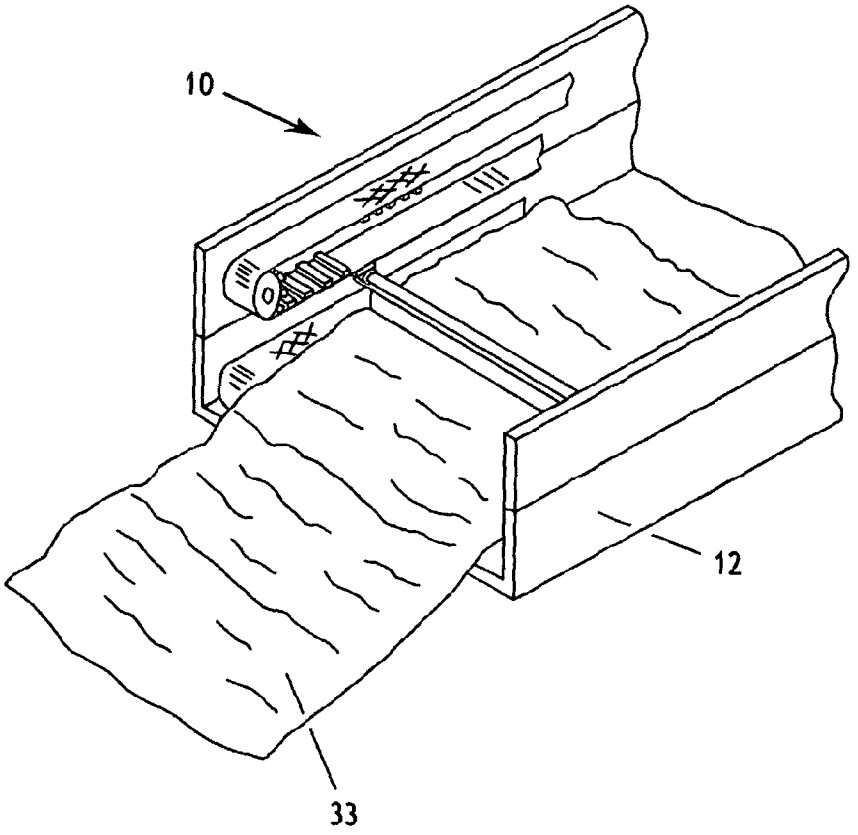


FIGURE 12

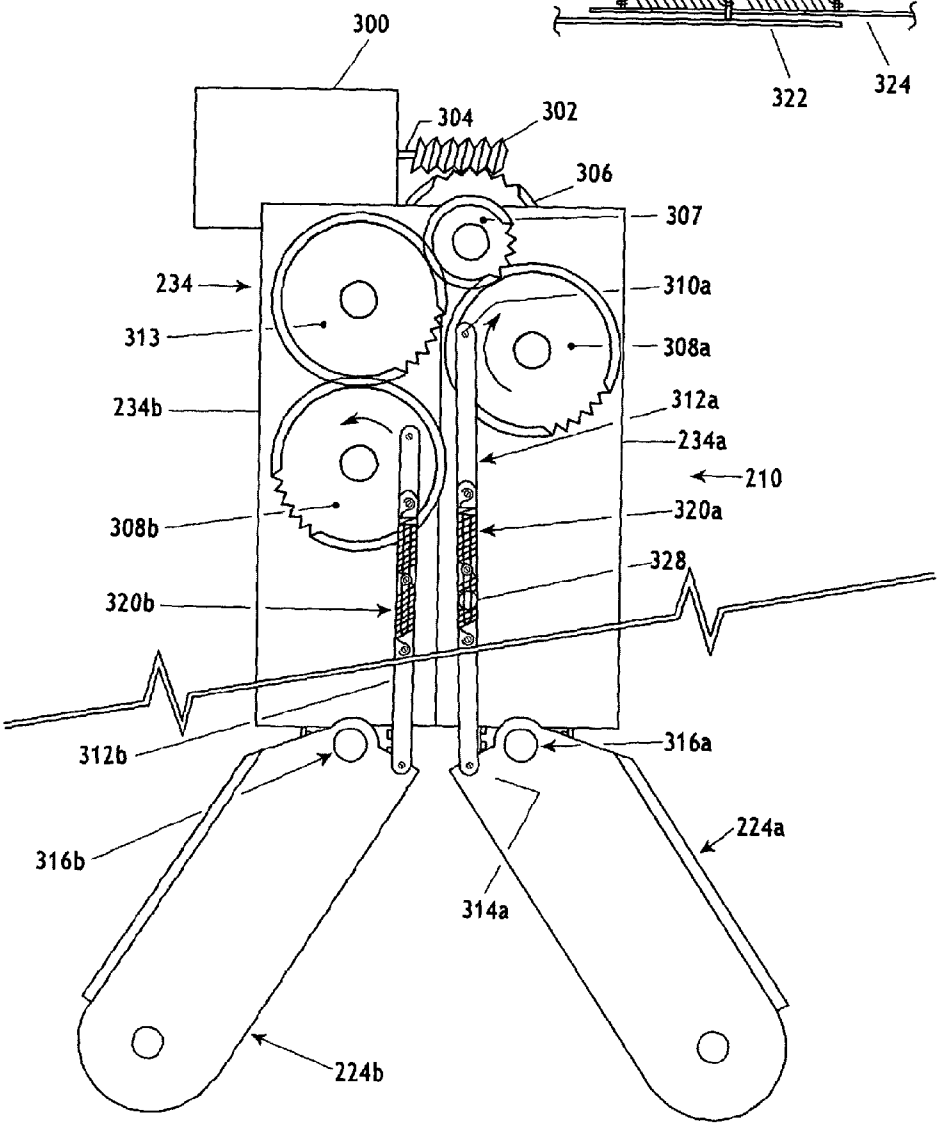


FIGURE 13

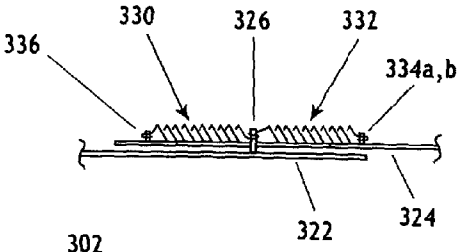


FIGURE 14

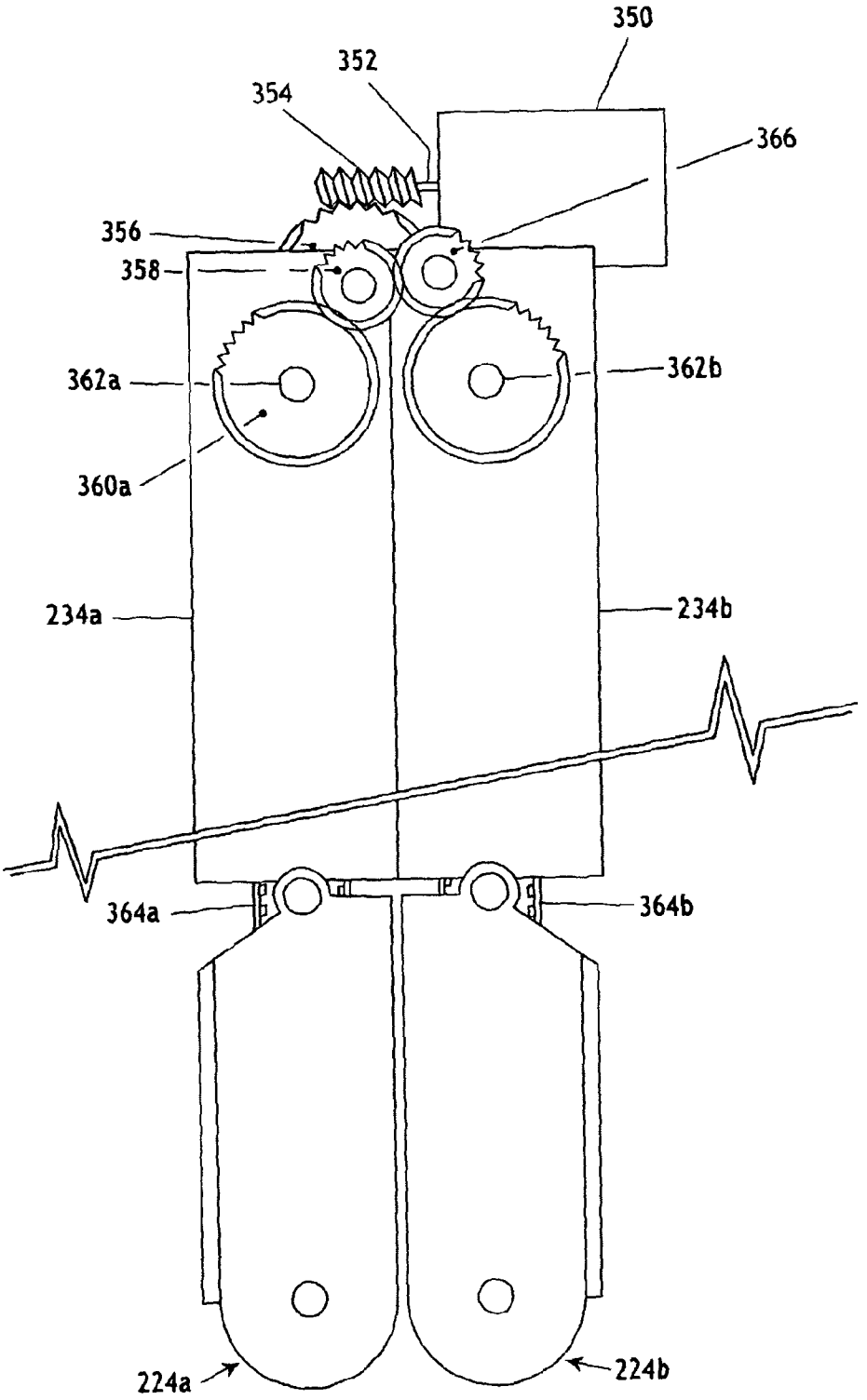

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FIGURE 15

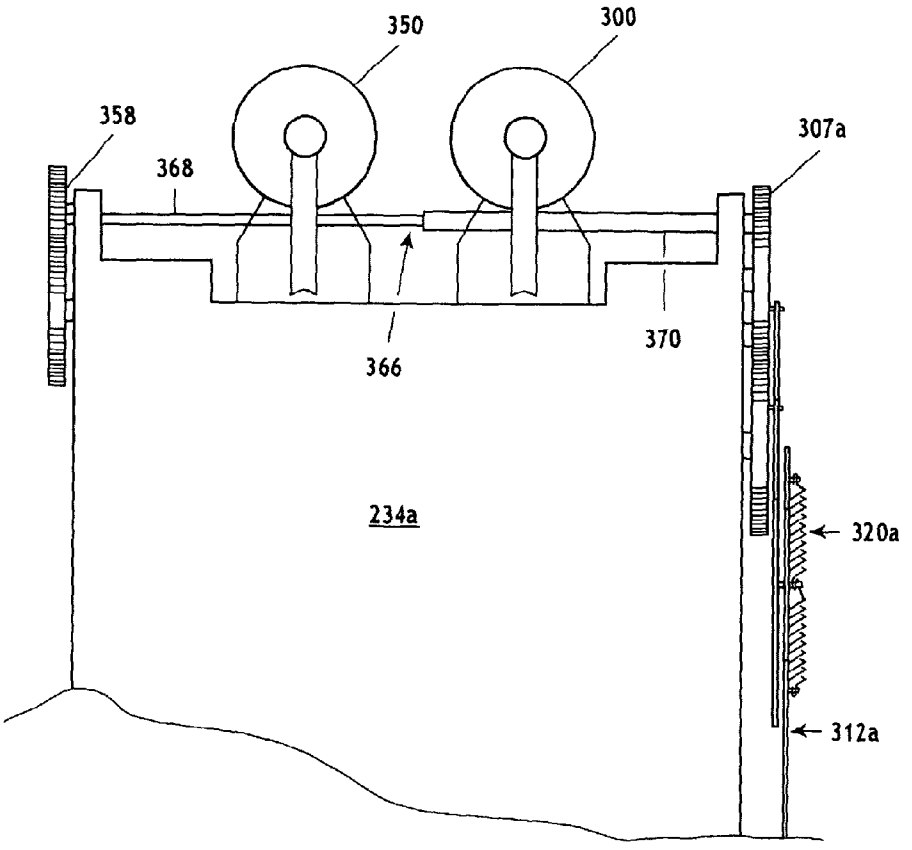


FIGURE 16

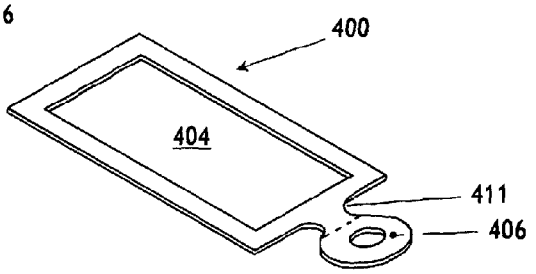


FIGURE 17

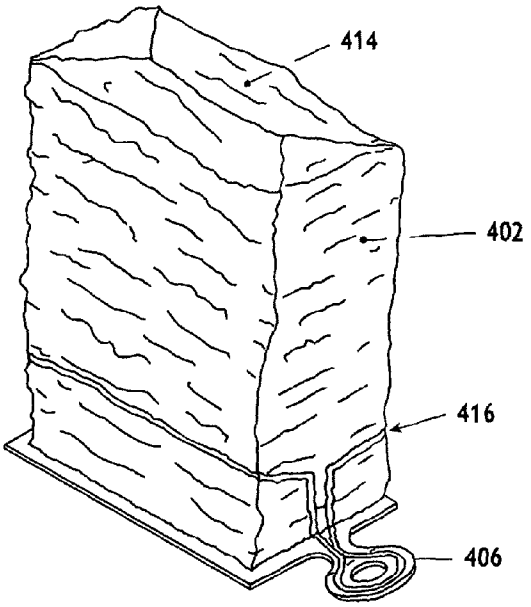


FIGURE 18

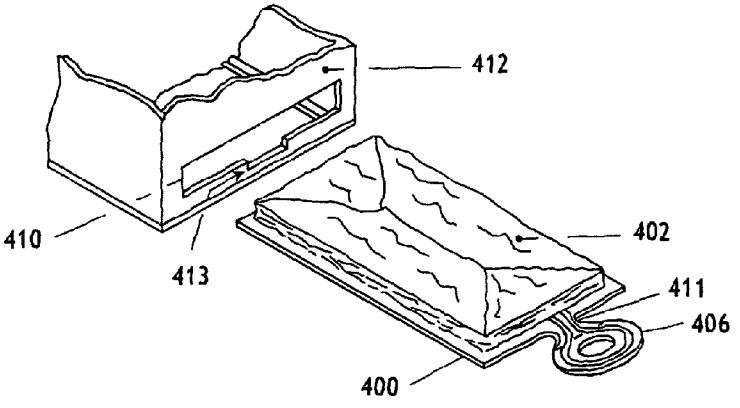


FIGURE 19

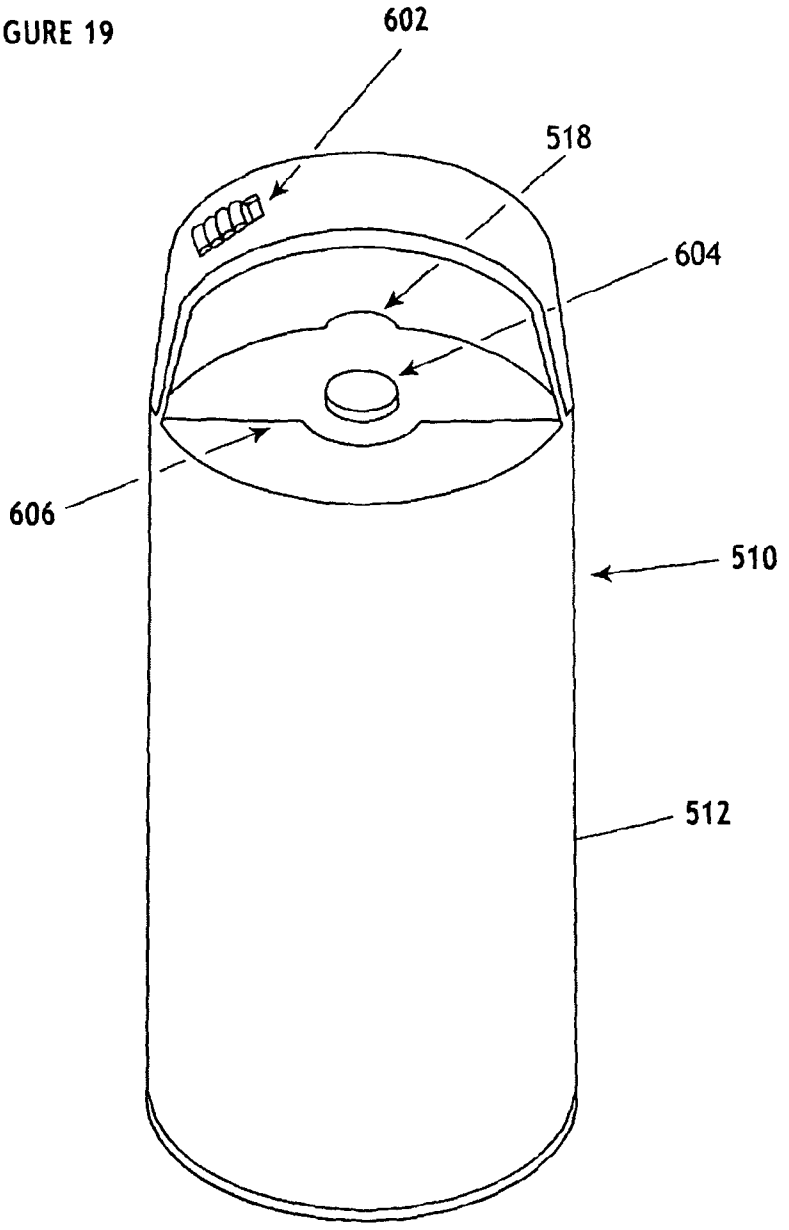
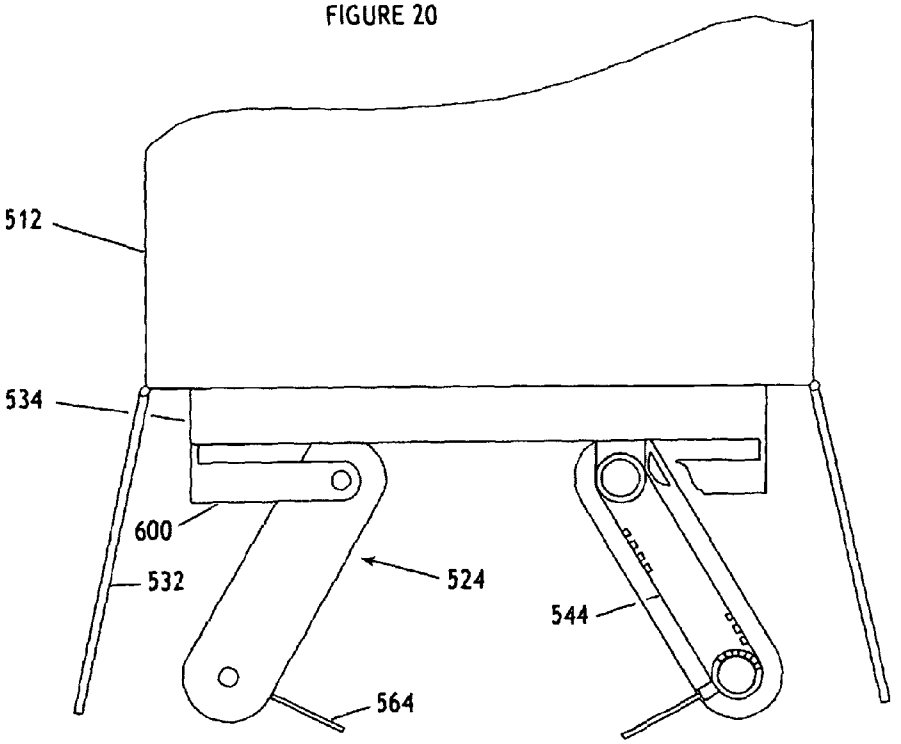


FIGURE 20



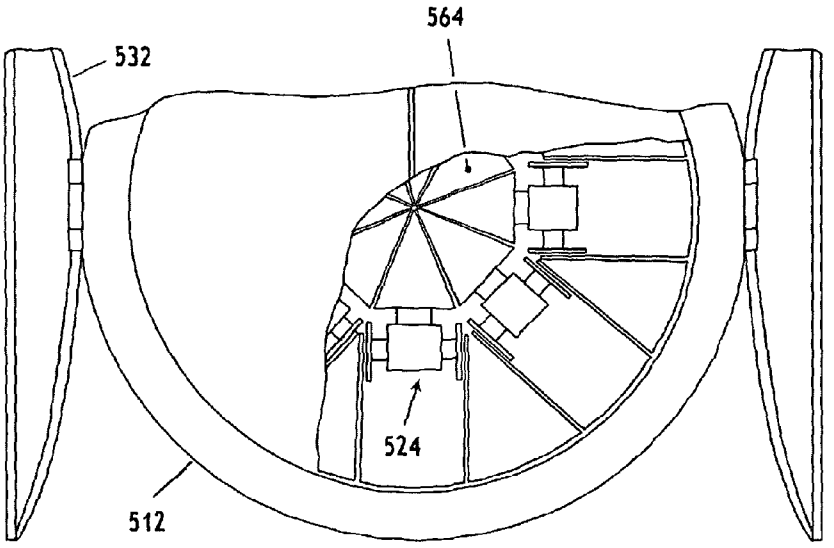


FIGURE 21

DEVICE AND METHOD FOR COLLECTION OF MATERIAL FROM A SURFACE

This application is a U.S. National Phase of International Application No. PCT/GB2012/051855, filed on Jul. 31, 2012, which claims priority of GB1113298.2, filed on Aug. 2, 2011. The contents of the applications are incorporated herein by reference in their entirety.

The present invention concerns a device and method for collecting material from a surface, and a liner for use with such a device.

The present invention is particularly, although not exclusively, applicable to the collection of animal faeces. The problems involved are well known to dog owners. It is difficult to prevent dogs from defecating indiscriminately. In urban environments dog walkers are often required to collect their pets' faeces and carry them to a suitable point of disposal.

To avoid direct contact with the faeces, it is a common practice to cover one hand with a plastic bag and grab the material, then pull the bag over the hand, turning it inside out in the process, so that the material is contained in the bag, whose open mouth can then be tied. The practice suffers from several drawbacks:

a. feeling the warm faeces through the bag is distasteful to some;
b. the pet owner has to bend down to pick the waste up;
c. the collected material must be carried to a point of disposal, and often for the rest of the walk, in a bag which may not be completely sealed, leading to a risk of leakage; and
d. the bag may be broken or ruptured, e.g. by use on rough ground or while being carried. Contact of the faeces with the pet owner's fingers, clothing etc causes risk of exposure to serious pathogens.

There are existing devices for use in collecting animal faeces. One can of course use a shovel, dustpan and brush, pet vacuum cleaner etc. The problem with such tools is that their surfaces are exposed to the material being collected and so become contaminated, requiring subsequent cleaning, which again exposes users to pathogens in the faeces which can cause serious illness. There are also various "scoop" devices on the market. An example is sold under the trade mark Flexrake 33P and has an elongate handle with a pair of pivotally mounted, scoop-shaped jaws at one end. A push/pull rod running along the handle is connected at one end to a user-movable grip and at the other end to the jaws, so that by moving the grip the user can draw the jaws together around the material to be collected. No provision appears to be made for retention of the collected material, which would thus need to be subsequently deposited in a suitable container. Also it appears that the jaws of the device must become contaminated by the collected material.

Another device for collection of dog faeces is marketed by Poopsta of Lancashire, England, and comprises a hollow cylindrical housing with an open end which is to be covered by a plastic bag. An elastic band is placed around the housing and the bag to ready the device for use. The housing's open end is then placed upon the ground, over the animal waste, and depressed, causing the elastic band to slip off the housing and contract, sliding the open end of the bag under the waste and causing it to be captured in the bag, which can then be placed within the housing by the user. A removable lid is then used to close the housing. The device has the advantage that the only surface which contacts the animal faeces is the interior of the plastic bag. Shortcomings include the number of operations that the user must carry out during each use, involving removal of the lid, placing the plastic bag over the housing's open end, placing the elastic band around it, placing the device over the waste and depressing it, placing the bag and collected faeces in the housing, and replacing the lid. Also the operation requires the user to bend or stoop to place the housing in position on the ground. The number of times that the device can be used without being emptied is limited.

An object of the present invention is to provide an improved device for collection of material, particularly but not exclusively waste material and still more particularly animal faeces. It is particularly desired to provide a device capable of repeated and convenient use. It is also desired to provide a device for collection of material which is able to operate without becoming contaminated by the material being collected.

In accordance with a first aspect of the present invention, there is a device for collecting material from a surface, the device comprising a housing for receiving collected material, a jaw arrangement which is able to be opened to provide a mouth for receiving the material and closed to collect the material, and a conveyor mechanism for advancing a liner, placed over the jaw arrangement to separate it from the material being collected, into the mouth, along with material collected therein, whereby the material is able to be collected into the housing and retained in the liner without making contact with surfaces of the device.

The invention allows the jaws, which would otherwise become contaminated by the collected material, to be covered by the liner. The collected material can be contained by the liner and moved into the housing for transport/storage/disposal without any need for the user to handle it and without contaminating any internal parts of the device.

It is especially preferred that the conveyor mechanism is operable when the jaw mechanism is closed. In this way the jaws can be closed around the collected material and then, in a separate and subsequent action, the conveyor can be operated to advance the liner and the collected material into the housing.

It is also preferred that the jaw mechanism and the conveyor mechanism are independently operable, so that the jaw mechanism is able to be opened and closed without advancing the liner. In this way the user can if need be try more than once to close the jaws around the material in order to collect it, before actuating the conveyor to move the material into the housing.

According to a second aspect of the present invention there is a liner for use with a collection device, the liner comprising an elongate tube of flexible material which is crushed, concertinaed or otherwise compacted to form a frame with an opening, allowing the frame to be placed around a part of the collection device for mounting.

The "frame" in question may for example be circular or square. It may be supported by some form of frame member additional to the liner itself, but this is not required.

In one embodiment the liner has, at intervals along its length, sealing strips able to form a seal across the liner when pressed against themselves. The sealing strips may be self adhesive strips or zips.

Specific embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIGS. **1***a* to **1***e* are simplified perspective illustrations of a first collection device embodying the present invention at successive points in its operation;

FIGS. **2***a* to **2***c* are sections through the same collection device taken in a vertical plane and again showing successive stages in the devices' operation;

FIG. **3** is an exploded view of an internal sliding casing of the same device and includes various working parts carried by the sliding casing;

FIG. **4** is an exploded view of an outer housing of the same device and includes various working parts carried by the housing;

FIG. **5** is a perspective view of part of the device's housing and associated component;

FIG. **6** is similar to FIG. **5** but shows a handle and related parts in a different position;

FIGS. **7***a* and **7***b* are simplified perspective views of the device showing how it can be opened to eject collected material;

FIG. **8** shows a liner for use with the device;

FIG. **9** is a simplified sectional view through the device in a vertical plane, showing details of a latch mechanism;

FIGS. **10***a* to **10***c* represent the latch mechanism on its own and show successive stages in its operation;

FIG. **11** is a perspective illustration of a modified version of the first collection device;

FIG. **12** shows some internal components of a second collection device embodying the present invention, viewed from a first side;

FIG. **13** is an enlarged view of a resilient linkage used in the second collection device;

FIG. **14** is similar to FIG. **12** but shows the device's internal components from a second side, opposite the first;

FIG. **15** shows the same internal components as FIGS. **12** and **14**, viewed from the front of the device;

FIG. **16** is a perspective illustration of a former for carrying a liner for use in a collection device embodying the present invention, the liner itself being omitted;

FIG. **17** is similar to FIG. **16** but additionally includes the liner, showing it opened out to reveal its shape;

FIG. **18** is a perspective illustration of the former, the liner, this time in a compact, pre-use configuration, and of a portion of a housing of a collection device which is adapted to receive the liner;

FIG. **19** is a perspective illustration of a third collection device embodying the present invention;

FIG. **20** shows a lower part of the third collection device viewed from one side and partly in section; and

FIG. **21** shows the third collection device viewed from above, parts of the device being cut away to reveal details of its interior.

The collection devices illustrated in the drawings are all intended for collection and carrying of animal faeces. In particular they are usable by dog walkers to collect dog faeces from the ground and allow them to be safely transported to a bin or other waste disposal facility. Such devices are colloquially referred to as "poop scoops". Note however that the present invention has potential applications in other fields, as will be explained below.

FIGS. **1***a* to **1***e* illustrate some major components of a first collection device **10** embodying the present invention and show the sequence of steps in the device's operation. In FIG. **1***a* the device **10** is configured for carrying. It can be seen to comprise a housing **12**, which in the present embodiment is generally cuboidal and is spilt along a line **14** into two separable parts. Other shapes and configurations of the housing are possible. The device can be provided with some form of strap or other means to facilitate carrying and in the present embodiment this takes the form of a shoulder strap **16**. The device has an extensible handle **18** whose end only is seen in FIG. **1***a*, the remainder of the handle being contained in the housing **12** so that the device forms a relatively compact shape which can be conveniently carried.

To ready the device **10** for use (FIG. **1***b*) the extensible handle **18** is drawn out of the housing **12**. The user can hold the device at upper end **20** of the handle **18** and because the handle is elongated it is not necessary for the user to stoop or bend to collect waste material from the ground. Also seen in FIG. **1***b* is a jaw arrangement **22**. When the device is configured for carrying (FIG. **1***a*) the jaw arrangement **22** is contained within the housing **12**. The action of withdrawing the handle **18** causes the jaw arrangement **22** to be advanced downwardly out of the housing **12**, and also to be opened ready for use in collecting waste material. In the illustrated embodiment the jaw arrangement comprises a pair of jaws **24***a*, **24***b* which are each pivotally mounted. The axis about which jaw **24***a* pivots is indicated at **26** in FIG. **1***b*. Other jaw configurations could be adopted. For example the arrangement could use a single movable jaw arranged to cooperate with a fixed jaw to collect waste material. The term "jaw" in this context refers to any part shaped and arranged to scoop or otherwise collect the waste material from the ground surface. In the jaws' open configuration they form a mouth **28** for receiving the waste material. The user places the device over the material to be collected (which is not shown in FIG. **1**) with the material in the mouth **28**. Lower edges of the jaws **24***a*, **24***b* are preferably in contact with the ground surface at this point.

A user-operable actuating part is provided to enable the user to close the jaws. In the illustrated embodiment this takes the form of a user-operable lever **30** toward the upper end of extensible handle **18**. The lever **30** is automatically deployed when the handle **18** is extended from the housing **12**. To this end, in the illustrated embodiment, the lever **30** is sprung toward an open position (FIG. **1***b*). Gripping the lever **30** causes the jaw arrangement **22** to close, as seen in FIG. **1***c*, collecting the waste material between the jaws.

Once the material has been collected into the jaws in this manner, the user can cause the material to be advanced into the housing for storage. In the illustrated embodiment the action of pushing the handle **18** into its stowed position within the housing **12** causes the jaw arrangement **22** to retract into the housing and at the same time, in a manner to be explained below, advances the waste material into the housing **12**. A hinged flap **32** closes the otherwise open lower end of the housing **12** when the jaw arrangement **22** is retracted—see FIG. **1***d*. After use the device **10** is returned to its carrying configuration—FIG. **1***e*.

An important aspect of the device not seen in FIG. **1** relates to its use of a liner **33** to cover the jaw arrangement and so separate it from the material being collected, so that contamination by the waste material is limited to the liner, with no surfaces of the device **10** itself needing to be brought into contact with the waste material being collected. This aspect, and the details of the device's internal mechanism, will now be explained with particular references to FIGS. **2** to **6**.

The liner **33** can be seen for example in FIGS. **2***a* to **2***c*. In the present embodiment the liner **33** is formed as an elongate tube. It comprises flexible and preferably impermeable sheet material. In the illustrated embodiment the material is thin plastics akin to the material of a plastic bag. Polyethylene film is one suitable material although there are many others. The liner **33** is passed around and over the jaw arrangement **22**, back through the jaw arrangement's mouth **28** and so into the interior of the housing **12**. The above-mentioned step of advancing the collected waste material into the housing **12** involves advancing the liner **33**, with the waste material contained in it, into the housing. The liner **33** thus contains the waste material within the housing **12**, preventing the material from contaminating the device's interior.

Looking at FIG. **2** in more detail, it can be seen that the device comprises a sliding assembly mounted in the housing **12** and incorporating the jaw arrangement **22**. In the illustrated embodiment this sliding assembly comprises a sliding casing **34** which is movable up and down within the housing **12** to advance/retract the jaw arrangement **22**. Details of the sliding assembly are illustrated in FIG. **3**. The sliding casing **34** is a box-like hollow structure formed in two parts which are separated from one another in FIG. **3** and designated **34***a* and **34***b* in that drawing. Runners **36***b* formed on second part **34***b* of the sliding casing have a dovetailed or otherwise undercut cross section. Complementarily formed guideways **38** are provided upon a second part **12***a* of the housing **12** (see FIG. **4**) to receive the runners **36***b* and so slidably mount the second casing part to the second housing part. The first casing part **34***a* is attached to the second casing part **34***b* through a hinge **37** (FIG. **3**) and is loosely tethered to the first housing part **12***a* so that when the housing **12** is opened, the sliding casing **34** opens along with it. When the housing **12** is closed for use, the two casing parts **34***a*, **34***b* mechanically engage with one another and so move as a unit.

Each of the casing parts **34***a*, **34***b* carries one of the jaws **24***a*, **24***b*. In FIG. **3** it can be seen that each of the jaws **24***a*, **24***b* comprises a lower casing portion **40***a*, **40***b* pivotally attached to the remainder of its respective casing part **34***a*, **34***b* through a respective hinge **42***a*, **42***b*.

Advancement of the liner **33**, and of the collected material, into the housing **12** is managed by means of a set of conveyors formed in the present embodiment as belts **44**, **46**. The relevant components carried by the first casing part **34***a* will now be described. Components carried by the first casing part **34***a* are denoted, in the following paragraphs, by the suffix "a." It is to be understood however that the second casing part **34***b* has a similar arrangement of belts and associated parts and in the drawings these are denoted by the suffix "b".

The first casing part **34***a* carries a pair of belts **44***a*, **46***a* which are laterally separated from one another. The belts are carried upon lower and upper axle assemblies **48***a*, **50***a* (the terms "upper" and "lower" refer herein to the orientation of the device in which it is seen in FIG. **1**, with the jaws lowermost). The lower axle assembly **48***a* is carried by the first jaw **24***a* toward its lower end. The lower axle assembly **48***a* carries a pair of pinions **52***a*, **54***a* upon which the respective belts **44***a*, **46***a* are mounted and the belts are internally toothed to engage with the pinions, providing positive drive without slip, so that the device's four belts move in step with one another. The upper axle assembly **50***a* is mounted by and within the sliding casing **34**, at or at least toward its upper end, and carries a further pair of pinions **56***a*, **58***a* upon which the respective belts **44***a*, **46***a* are mounted. To maintain belt tension as the jaws are opened and closed, the upper axle assembly **50***a* is movable and is acted upon by tension springs **60***a* (see FIG. **2**). Comparing FIGS. **2***a* and **2***b* it can be seen that these springs are extended when the jaw **24***a* is in its open position (FIG. **2***a*) and contract, drawing the upper axle assembly **50***a* upwards to maintain belt tension, when the jaw moves to its closed position (FIG. **2***b*). Guides **62***a* formed within the sliding housing **34** constrain the paths taken by the belts **44**, **46** in the vicinity of the hinges **42** and prevent the belts from rubbing on other parts of the device when the jaws **24***a*, **24***b* are opened (see FIG. **2***a* in particular).

The two belts **44***a*, **46***a* carried by the first casing part **34***a* are linked to one another by a set of collecting paddles **64***a*. The term "paddles" as used herein does not in itself imply any particular shape for these components, which could take any of a number of different forms commensurate with their function. In the illustrated embodiment they are formed as elongate slender panels standing up from the belts' outer faces.

As noted above, the second casing part **34***b* carries its own arrangement of second belts **44***b*, **46***b*; second upper and lower axle assemblies **48***b*, **50***b*; second pinions **52**-**58***b*; second tension springs **60***b* and second guides **62***b*, all of them similarly formed to the corresponding parts carried by the first casing part **34***a*.

A mechanism is provided for advancing the two sets of belts **44***a*, **46***a* and **44***b*, **46***b* together. In the illustrated embodiment, this is achieved by means of a rack and pinion drive whose rack **66** is carried by, and within, the housing **12** and meshes with a pinion **67** mounted on the second upper axle assembly **50***b* to drive it, and so drive the second belts **44***b*, **46***b*. To transfer drive to the first belts **44***a*, **46***a*, the second upper axle **50***b* carries, on the side of the casing **34** opposite the rack and pinion drive, a transfer gear **66***b* which meshes with an identical transfer gear **68***a* carried by the first upper axle assembly **50***a* (see FIG. **3** in particular). A ratchet mechanism **47** (see FIG. **3**) ensures that the axle assemblies **50***a*, **50***b*, and the belts **44***a*, **46***a*, **44***b*, **46***b* that they carry, can turn only in one direction. In FIG. **2***b*, the first upper axle assembly **50***a* is able only to turn clockwise and the second upper axle assembly **50***b* only anticlockwise, causing the liner **33** to advance into the housing **12**.

The manner in which collected waste material is advanced into the housing **12** can now be understood, referring once more to FIGS. **2***a* to **2***c*. After the jaw arrangement **22** has been closed (FIG. **2***b*), the sliding casing **34** is withdrawn into the housing **12**. This motion of the casing **34** causes the axle assemblies **48**, **60** to turn, advancing the belts **44**, **46**. At the beginning of this motion, a pair of first and second paddles **64***a*, **64***b* lie opposite and adjacent one another and at lower ends of their respective jaws **24***a*, **24***b*. These paddles collect and contain the waste material, which is item **70** in FIG. **2**. As the belts advance, the waste material and the liner **33** around it are moved, by the action of the paddles **64***a*, **64***b*, into the device's interior. Note that by virtue of the lateral separation of the pairs of belts **44**, **46** (seen in FIG. **3**), the waste material is not squeezed between the belts but instead is allowed to occupy as much of the volume within the sliding casing **34** as it requires, causing the liner **33** to correspondingly bulge, as seen at **72** in FIG. **2***c*, whilst at the same time being retained between pairs of paddles **64***a*, **64***b* above and below.

A mechanism is provided to move the sliding casing **34** between the retracted position of FIG. **2***c* and the advanced position of FIGS. **2***a* and **2***b*. This mechanism can best be seen in FIG. **4**. As noted above, in the illustrated embodiment it is the act of extending/retracting the handle **18** that causes the sliding casing **34** and the jaw arrangement **22** to advance/retract. However the distance through which the handle **18** moves is larger than the distance through which the sliding casing **34** moves. One solution to this problem would be to have the handle **18** engage with the casing **34** for only a short part of its stroke. However a more elegant solution, providing the user with mechanical advantage in the actuation of the mechanism, is found in the present embodiment. A pair of actuating levers **76**, **78** is carried upon the second housing part **12***b*. Each lever pivots about a respective fulcrum **80**, **82** which is fixed with respect to the housing **12**. Each has a respective slot **84**, **86** running along its length. The handle **18** carries an actuating pin **88** which is received in both slots **84**, **86** as a sliding fit. On the opposite side of the fulcrum **80**, **82** from the actuating pin **88**, each actuating lever **76**, **78** has a respective engagement pin **90**, **92** which projects into a corresponding lateral slot **79** formed in the sliding casing **34** (see FIG. **3**).

Moving the handle **18** causes the actuating levers **76**, **78** to turn and so causes the sliding casing **34** to move up/down. Note that the mechanism provides a reverse: of direction—when the handle **18** is moved downward, to retract it, the sliding casing **34** moves upward, to correspondingly retract the jaw arrangement **22**. Also because a distance between the fulcrum **76** or **78** and the actuating pin **88** is longer than the distance between the fulcrum **76** or **78** and the respective engagement pin **90**, **92** the mechanism provides the required mechanical advantage—that is, the handle **18** moves through a longer stroke than the sliding casing **34**.

The handle **18** is coupled to the housing **12** in a manner which provides for its extending/retracting motion. In the illustrated embodiment the handle **18** terminates in a carriage plate **94** slidably mounted between two rails **96** formed within the housing **12**.

A user-operable mechanism is provided for closing the jaw arrangement **22**. Note in this regard that the user is able to control movement of the jaw arrangement independently of the advancement and retraction of the jaws so that if need be the user can make more than one attempt at closing the jaws around the waste material, before completing the process by retracting the jaws and thereby moving the collected material into the housing **12**. Each of the jaws **24***a*, **24***b* is controlled through a respective pair of jaw actuating rods **100***a*, **100***b*. One of each pair can be seen in FIG. **3**, being mounted on a side face of the sliding casing **34**. The other member of each pair is on the opposite side of the sliding casing **34** and so not seen in the drawing. Each jaw actuating rod **100***a*, **100***b* couples to a respective hinged casing portion **40***a*, **40***b* through a respective pivot **102***a*, **102***b* which is laterally offset from the corresponding hinges **42***a*, **42***b* so that by moving the jaw actuating rods **100***a*, **100***b* the jaws **24***a*, **24***b* can be opened and closed.

The jaw actuating rods **100***a*, **100***b* are coupled, through slots in side was of the sliding casing **34**, to "L" shaped coupling parts **104**, **106** seen in FIGS. **4** to **6** and arranged outside and on opposite sides of the sliding casing **34**. FIG. **5** shows pivot rods **108**, **110** which pivotally engage with the jaw actuating rods **100**. The two coupling parts **104**, **106** are linked by a cross member **112** so that they move together to open and close the jaws. The pivot rods **108**, **110** are received in slots **107** (see FIG. **3**) which provides freedom for the jaw assembly to be retracted.

As explained above, the user closes the jaws by means of a lever **30** which is near the upper end of the extensible handle **18**. To this end, the handle **18** is hollow and contains, as seen in FIG. **4**, a pair of coupling levers **114**, **116** to convert rotational motion of the lever **30** to linear movement of a coupling rod **118** which extends through the handle **18**, emerging into the outer housing **12** at the handle's lower end to meet a T bar **120** which is carried beneath the carriage plate **94** through mushroom shaped buttons **122**, **124**. The buttons slide captively in short slots **125** in the carriage plate **94** to allow the T bar **120** to more relative to the carriage plate **94**.

When the user squeezes the lever **30**, the coupling rod **118** is drawn upwardly. This motion is transmitted through the T bar **120**, abutting the cross member **112**, to the coupling parts **104**, **106** and so to the jaw actuating rods **100***a*, **100***b* and to the jaws **24***a*, **24***b*, causing them to close.

Note that because the T bar **120** is not coupled to the cross member **112**, the mechanism does not hinder retraction of the handle **18** into the housing **12**. As seen in FIG. **6**, retraction simply causes these parts to move away from one another. The mechanism can thus urge the jaws to close but cannot cause them to open. Opening of the jaws is caused by a spring arrangement which is not seen in the figures but may for example comprise torsion springs acting on the casing portions **40***a*, **40***b*.

The collection device can be used multiple times before it requires emptying. That is, the user can repeat the sequence of steps explained with reference to FIG. **1** twice or more. When the user reaches a suitable waste disposal point, however, the device needs to be emptied. FIGS. **7***a* and **7***b* show one way that this can be done. The housing **12** is formed in two separable parts, as noted above. In the present embodiment these are coupled along their top edges through a housing hinge **128**. Opening the housing **12** about the hinge separates the two parts of the sliding casing **34**, allowing the collected material, carried in the liner **33**, to fall or be removed from the device (FIG. **7***b*).

For the convenience of the user, the present embodiment incorporates a release button **130** used to open the housing **12**. In FIG. **4** it can be seen that the release button is mounted in a first part **12***a* of the housing **12**, in an upper wall thereof, and is coupled through a release bar **132**, which is upwardly biased by a spring **134** and extends around the inner periphery of the housing **12**, to a pair of bolts **136** on opposite sides of the device. When the user closes the housing **12** by pushing its two parts together, the bolt **136** first rides along an inclined face **138** of a catch **140** formed on second part **12***b* of the casing, then snaps into an undercut inner face **142** of the catch **140** to secure the casing parts **12***a*, **12***b* together. Depressing the release button **130** causes the bolt **136** to slide downwards, disengaging it from the catch **140** and allowing the housing **12** to open.

Looking at FIG. **2** it will be recognised that the paddles **64***a*, **64***b* carried on opposite parts of the sliding casing **34** need to be aligned in pairs to perform their function. While the housing **12** and the sliding casing **34** are closed, meshing of the drive gear **68** and the driven gear ensures that the paddles advance in step and remain properly aligned. However when the sliding casing **34** is opened these gears are separated and there is the possibility that one will turn relative to the other, taking the paddles out of alignment. To prevent this from happening, a latch mechanism locks the gears when the sliding casing **34** is opened. FIG. **3** shows the details. The upper axle assemblies **50***a, b* each carry a latching gear **144***a, b* associated with a respective locking bar **146***a, b* which is biased toward engagement with its latching gear to prevent rotation. Pushrods **148***a, b* are arranged to disengage the locking bars when the sliding casing **34** is closed. When the sliding casing **34** is opened, the pushrods are released, the locking bars engage and rotation of the gear mechanism is prevented.

Consideration also needs to be given to the manner in which the liner **33** is inserted into the collection device to prepare it for use. The liner **33** may be provided to the user in the form seen in FIG. **8**. A length of tubular liner material sufficient for multiple uses is collapsed into a small volume in the manner of a concertina and is carried on a rectangular frame, making it easy to insert the concertinaed lining into the device, around the sliding casing **34**. To install the liner **33** ready for use, the end of the liner is pulled downward around the extended and open jaw arrangement **22** and is then fed back into the jaw's open mouth **28**. At this point the liner **33** needs to be gripped by the paddles **64** to enable it to be advanced into the collection device. To this end, the device comprises a jaw latch mechanism so that the jaws can be pushed closed by hand, gripping the liner **33**, and kept closed while the mechanism is advanced. The latch mechanism automatically releases when the jaws are retracted. FIGS. **9** and **10***a*-**10***c* show a suitable jaw latch mechanism comprising a

hook **150** pivotally mounted on one of the jaws **24***a* and arranged to be engageable with a latch pin **152** on the other of the jaws **24***b* tri latch them closed. The hook **150** is coupled to a latch rod **154** which is mounted to the sliding casing **34** in a manner which permits it to move longitudinally, its upper end being elbowed to form a laterally projecting spring arm **156**. A peg **157** is provided on an inner face of the housing **12** and arranged to engage the spring arm **156**. Initially, following manual closing of the jaw arrangement **22**, the spring arm **156** lies beneath the peg **157** (FIG. **10***a*) and maintains the hook **150** in its "latched" position. However as the sliding casing **34** is retracted into the housing **12**, the spring arm is forced past the peg **157**, releasing the latch mechanism so that the jaws can be subsequently be opened for use.

The liner **33** may be blind-ended. That is, the end of the liner **33** for insertion into the mouth **28** is closed. Also this end of the liner may be provided with a grippable feature **159** with which the paddles can engage to entrain the liner **33**.

It is desirable to minimise external dimensions of the device to make it as convenient as possible for carrying. To this end the paddles **64** may be formed in a manner which allows them to "feather" on their return path, lying against the belts **44**, **46** on which they are carried and so minimising the volume within the device that needs to be provided for them. FIG. **3** omits most of the paddles **64** themselves, showing only pads **158** on which the paddles are to be mounted, but shows an internal guide plate **160** which causes the paddles **64**, which may be formed of resilient material or could for example be mounted on the pads **158** through pivots, to lie down against the belts as they pass inclined guide surfaces **162**.

It is desirable to prevent any material from escaping once it has been collected into the liner **33**. In some embodiments the paddles **64** alone serve to retain the collected material. However means may be provided for forming a seal across the liner beneath the collected material. In one such embodiment (not illustrated) self adhesive strips are provided at intervals across the interior of the liner **33** and are positioned to be pressed together by the paddles **64** to form the desired seal. An alternative is to provide the collection device with means for heat sealing the liner **33** after it has been advanced. Another alternative is to use zips, e.g. of the moulded plastics variety, at intervals along the liner to close it.

Heat sealing may be achieved by providing the paddles **64** with heating elements on their outer edges. In this case the paddles may be arranged in parallel pairs closely spaced along the directions of travel of the belts on which they are carried, so that the leading paddle of a pair will serve to contain the collected material. The other paddle of the pair is provided with the heating element and follows the first. In this way the heating element is prevented from coming into close contact with the collected material.

While the above described embodiments provide for the housing to be opened to eject collected material, another possibility is to have the collected material fed out of the device. FIG. **11** illustrates the principle. The liner **33** is able to emerge through the top of the housing **12**. The internal mechanism may for example be able to freewheel to allow the liner to be pulled through, or alternatively, repeated actuation of the mechanism may serve to eject the liner and the material collected in it.

The collection device **210** illustrated in FIGS. **12** to **15** differs from the above described collection device **10** in that certain parts of its mechanism are power operated rather than being manually operated. More specifically, the collection device **210** uses electric motors to drive (a) the opening and closing movement of the jaws and (b) advancement of the conveyor mechanism to draw collected material into the device. These two functions are independently power driven and, as will be explained further below, the sequence of operations can, in a motor driven version, be electronically controlled.

Details of the mechanism for driving opening and closing of the jaws are best seen in FIG. **12**. This drawing shows a sliding casing **234** similar to the sliding casing **34** of the earlier described embodiment, and once more comprising hingedly coupled first and second casing parts **234***a*, **234***b*. Pivotally coupled to each casing part **234***a*, **234***b* is a respective jaw **224***a*, **224***b*. The conveyor mechanism of the second collection device **210** is not seen in the drawings but may be similar to that of the first collection device **10**.

Also omitted from FIGS. **12** to **15** are (a) the external housing, item **12** in the drawings of the first collection device and (b) the mechanism that moves the sliding casing **234** within the housing to advance/retract the jaws. Again, these aspects of the second device **210** can match the corresponding features of the first device **10**. In particular, advancement and retraction of the jaws and the sliding casing can be carried out using the manual lever arrangement and retractable handle of FIG. **4**, although in other embodiments that function could also be motorised.

An electric motor **300** drives the jaws **224***a*, **224***b*. The motor is supplied with electric power by one or more batteries carried in the device's housing, but the adaptation of the housing to receive the batteries is conventional and is not shown in the drawings. Leading from the motor to each of the jaws **224***a*, **224***b* is a respective drive mechanism comprising a speed reducing gear train, to amplify the modest torque available from the motor **300**, and a crank and pushrod arrangement leading to the jaws **224***a*, **224***b*. The gear trains use a worm **302** carried on a shaft **304** of the electric motor **300** to drive a toothed worm wheel **306**. A pinion **307** which is coaxial with the worm wheel **306** and mounted to rotate along with it drives first and second crank gears **308***a*, **308***b* carried by respective casing parts **234***a*, **234***b*.

The first crank gear **308***a* carried by the first casing part **234***a* serves as a crank by virtue of a pivotal coupling **310***a* to a first pushrod **312***a*. The pushrod has a further pivotal coupling **314***a* to the first jaw **224***a*, this coupling being offset from pivot **316***a* by which the jaw is mounted. When the motor shaft **304** turns, the first crank gear **308***a* turns along with it and drives the first pushrod **312***a* reciprocally to move the first jaw **224***a* between its closed and open positions.

Gearing carried by the second casing part **234***b* differs from that carried by first casing part **234***a* only in that it additionally incorporates a reversing gear **313** between second crank gear **308***b* and pinion **307**. This is needed in order that the first and second crank gears **308***a*, **308***b* rotate in opposite directions. A second pushrod **312***b* couples the second crank gear **308***b* to the second jaw **224***b* to move it between its closed and open positions, and of course the gearing is arranged such that the jaws **224***a*, **224***b* open and close in unison.

The pushrods **312***a*, **312***b* incorporate respective resilient couplings **320***a, b* which serve to protect the jaw drive mechanism from damage. If for some reason excessive force is applied to the jaws **224***a,b*, tending to open or close them, the resilient couplings **320***a, b* allow the jaws to move independently of their drive mechanisms, to avoid overloading them. FIG. **13** shows one of the resilient couplings **320**, which in this particular embodiment uses a pair of pre-stressed helical springs acting in opposition to one another. The pushrod **312** is broken into two parts **322**, **324**. A peg **326** carried by one pushrod part **322** projects through a slot **328** (see FIG. **12**) in the other pushrod part **324**. The two springs **330**, **332** each

couple to the peg **326** and extend from it in opposite directions to respective further pegs **334**, **336** carried by the other push-rod part **324**. If force on the pushrod **312**, in either direction along its length, exceeds the force with which the springs **330**, **332** are pre-stressed then the pushrod **312** yields, its length changing as its two parts slide relative to one another, allowing the corresponding jaw **224***a* or *b* to move. Clearly the required resilience could be incorporated into the drive mechanism in numerous other ways.

In the present embodiment the jaws **224***a,b* are hinged about shafts **316***a, b* which coincide with centre lines of the respective conveyor belts **364***a,b*, which can just be seen in FIG. **14**, so that the length of the conveyor's path does not change significantly as the jaws **224***a,b* move. Consequently tensioning springs **60***a, b* of the first embodiment can be dispensed with.

The mechanism for driving the conveyor is seen in FIG. **14** and comprises a second electric motor **350** whose shaft **352** carries a worm **354** for driving a worm wheel **356** and a pinion **358** coaxial with the worm wheel. The first casing part **234***a* has a first conveyor drive gear **360***a* which meshes with the pinion **358** and which is mounted on a first conveyor shaft **362***a* which drives a first conveyor arrangement one of whose belts can be seen at **364***a* in the drawing. The gear train leading to second conveyor shaft **362***b* carried by the second casing part **234***b* is different in that it includes a reversing gear **366**, in order that conveyor shafts **362***a,b* rotate in opposite directions.

In the first described collection device **10**, a latch mechanism is provided to lock the conveyor mechanisms when the user opens the sliding casing **34**, to prevent the respective conveyor mechanisms carried by the casing parts **34***a*, **34***b* from becoming misaligned with one another. The second collection device **210** does not require any such latching mechanism because as its casing **234** is opened the gear trains for driving the jaws and the conveyors do not disengage. Looking again at FIG. **12**, for example, the axis of the pinion **307** coincides with the axis of a hinge coupling the two casing parts **234***a, b*. As the casing parts pivot about this axis relative to one another, the first crank gear **308***a* and the reversing gear **313** describe circular arcs about the axis, and so stay in mesh with the pinion **307**. FIG. **15** shows that the pinion **307** and the pinion **358** are carried on the same shaft **366** that serves as the hinge coupling the two casing parts **234***a, b*, although to allow the two pinions to rotate independently the shaft is formed in two concentric parts **368**, **370**, one being received in the other.

The motorised mechanisms are controlled by user-operable switches (not shown) carried on the handle, which may, in the present embodiment, be generally similar in construction to the handle **18** of the first embodiment. A jaw control switch can be moved by the user between forward, reverse and off positions, running the jaw actuating motor **300** in one direction to open the jaws and in the opposite direction to close them. Limit switches or sensors of other type (not shown) are provided to detect when the limit of the jaws' travel in either direction has been reached, and to turn off the motor **300** in response. The limit switches may engage with the gearing or with the jaws **224***a, b*.

A user-operable conveyor switch (not shown) is carried by the handle and is actuable by the user to activate the conveyor motor **350**.

A logic circuit is provided, receiving signals from sensors/switches, to ensure that operations are carried out in appropriate sequence, for example by (a) detecting when a pair of paddles are positioned adjacent each other at the bottom of the jaws **224***a,b*, ready to collect the next load of waste material, and stopping the conveyor motor **350** in response; (b) detecting when a bag is inserted; (c) detecting whether the jaws are retracted and preventing the jaw actuating motor **300** from running when they are etc. The logic circuit may comprise discrete electronic components, a suitable arrangement of switches, and/or programmed microprocessor. Its design would be straightforward for the skilled person and details are not provided herein.

The collection device **210** uses a rack and pinion arrangement (not shown) to drive advancement and retraction of the jaws, as in the earlier embodiment, but an alternative is to motorise that function as well. For example a switch or sensor may be provided to detect when the handle is collapsed and to retract the jaws in response.

FIGS. **16** to **18** show alternative means for packaging and for installing the liner used to prevent the components of the device from contacting the material being collected. A frame **400** carries the liner **402**. FIG. **16** shows the frame on its own and in the present embodiment it comprises flat sheet material forming a rectangular shape with an opening **404** and a pull tab **406**. The preferred material for the frame **400** is cardboard but plastics sheet or other suitable materials may be used. As supplied to a user, the liner **402** is carried upon the frame in a compact state, being concertinaed or otherwise crushed to lie adjacent the frame (FIG. **18**). The liner's mouth is attached to the frame **400**, surrounding the opening **404**, as can be appreciated from FIG. **17**. This attachment can be formed by bonding. Housing **412** has a slot **410** in one of its side faces, into which the frame and liner **400**,**402** in the compact state can be inserted, and the housing has internal features (not seen) such as rails to receive and locate the frame **400**. A waisted portion **411** of the pull tab **406** clips into a recess **413** in the periphery of the slot **410** to keep the frame and liner in place. A hinged sealed cover (not shown) can trap the pull tab **406** and close the slot **410** to seal any odours in the housing. To insert the frame and liner **400**,**402** into the housing **412**, the jaws **24***a*, **24***b* or **224***a*, **224***b* must be retracted, in which state they lie above the frame **400**. When the jaws are advanced, they move through the opening **404** in the frame **400**, drawing the liner **402** with them so that the jaws are covered by the liner **402**. The liner needs to pass back into the mouth **28** formed by the jaws **24***a, b*, **224***a, b* to enable it to be drawn into the device by the conveyors (refer again for example to FIG. **2***a*, which shows the liner **33** in a suitable configuration) but this can be easily achieved either by having the user push the liner into the mouth **28**, or simply by the effect of the material **70** being collected (see FIG. **2***a* again) which presses the liner into the mouth **28**. Note that in the present embodiment the liner **402** is formed in the manner of a bag, having a closed end **414**. A liner of this type may be formed to permit only a small number of collection operations—e.g. two—before it must be replaced. In this case the conveyors of the collection device may need only a corresponding number of paddles. After collection of material the pull tab **406** can be torn off the framed **400** to pull tight a drawstring **416**, preventing release of the collected material.

It is to be understood that the collection device described above serves as an example only of how the invention can be put into practice. Some variants will now be described.

While the above described devices are intended particularly for collection of animal faeces, embodiments of the present invention may be put to any of a range of other uses. There are other situations which require collection of material without contamination of the collection device. Hazardous waste may require such treatment, for example. While the illustrated embodiments are manually actuated, others could use powered means to provide the required actions.

The liner **33**, **402** may have a surface that is textured or spiky, or may have an adhesive surface to assist in collection. The paddles may have edges that are gapped, serrated (subject to their being suitably shaped not to damage the liner) or otherwise shaped to assist in collection of material. They may have flexible fingers to allow the contours of an uneven surface. They may incorporate magnets to draw pairs of paddles together, improving the seal across the liner **33**, **402**. The paddles may be formed from a range of materials such as rubber, metal or plastics. It is preferred that the belts and the paddles should be formed from a single piece moulding. One pair of paddles may be followed, after a short space along the conveyor, by another, so that the two pairs of paddles form a double seal against escape of material.

The toothed belts **44**, **46** could in other embodiments be replaced by for example chain, flat belts V belts etc. While the mechanism used to advance the liner and the collected material into the housing is referred to as "conveyor" at various points herein, this implies merely that it is able to convey the liner and collected material into the housing and does not necessarily require the use of chains or belts. For instance the liner could be advanced by rollers, or grabbed and pulled by a reciprocating device.

Many variations in the construction and operation of the collection device are possible, within the scope of the present invention. For example, FIGS. **19**, **20** and **21** show a generally cylindrical collection device **510** embodying the present invention. In this embodiment housing **512** is a hollow cylindrical body and carries a set of jaws **524** which are equiangularly spaced about the housing's central axis. The illustrated example has eight jaws **524** but a different number of jaws could be used. Each jaw **524** has its own conveyor **544** carrying paddles **564** which are triangular in shape and which tessellate when the jaws **524** are closed (FIG. **21**) to close the device's mouth and collect material into it. As in previous embodiments the collection device **510** has a liner to cover the jaws and protect them from contact with the collected material. The liner is omitted from FIGS. **19** to **21**. The jaws **524** are coupled by gearing or some other actuating mechanism (not shown) to open and close in unison, and as in the earlier described embodiments once the jaws have been closed to collect waste material it is drawn into the housing **512** by the conveyors **544**. In the present embodiment the jaws **524** and the conveyors **544** are driven by electric motors via orbital gears housed in the top of the device's sliding casing **534**. The jaws **524** are supported by brackets **600** cantilevered from the sliding casing **534**. A switch **602** on an upper part of the housing **512** releases telescopic handle **518** to allow the housing **512** to be lowered to ground level and to open twin flaps **532** and advance the jaws **524**. The housing **512** is formed in two parts hinged to one another about line **606** in FIG. **19**. Depressing a release button **604** allows the two parts of the housing to be opened about the hinge to allow collected material to be removed.

In other variants of the collection device a single movable jaw could be used. It could, for example, be opposed by a static jaw.

The invention claimed is:

1. A device for collecting material from a surface, the device comprising

a housing for receiving collected material,

a jaw arrangement which is configured to open to provide a mouth for receiving the material and to close to collect the material, and

a conveyor mechanism comprising at least one belt or chain passed around a member mounted on a movable jaw of the jaw arrangement so that the belt or chain is moved along with the jaws as they open and close, which is operable when the jaw arrangement is closed to advance a liner, placed over the jaw arrangement to separate it from the material being collected, so that in use the jaw arrangement is operable to be closed around the material to be collected and then the conveyor mechanism is operable to advance the liner and the material collected in it through the mouth and into the housing, the collected material being retained in the liner without making contact with surfaces of the device.

2. A device as claimed in claim **1** in which the jaw arrangement is operable independently of the conveyor mechanism so that the jaw arrangement is able to be opened and closed without advancing the liner.

3. A device as claimed in claim **1** in which the conveyor mechanism is adapted to advance a predetermined distance each time it is operated.

4. A device as claimed in claim **3** in which the belt or chain carries at least one paddle for collecting material.

5. A device as claimed in claim **4** comprising at least one pair of belts or chains separated from one another and linked by the paddle.

6. A device as claimed in claim **1** comprising at least two belts or chains each carrying a plurality of paddles positioned to contact one another upon closure of the jaw arrangement to collect material.

7. A device as claimed in claim **1** in which the yaw arrangement is retractable into the housing.

8. A device as claimed in claim **7** in which the jaw arrangement is carried upon a sliding assembly within the housing.

9. A device as claimed in claim **8** in which the sliding assembly comprises a sliding casing into which the liner is advanced by the conveyor mechanism.

10. A device as claimed in claim **9** further comprising a mechanism for moving the sliding assembly in a reciprocating motion.

11. A device as claimed in claim **10** in which movement of the sliding assembly causes the conveyor mechanism to advance.

12. A device as claimed in claim **11** further comprising a rack and pinion mechanism arranged to drive the conveyor mechanism as the sliding assembly is moved.

13. A device as claimed in claim **1** in which the housing is formed in two parts enabling it to be opened to remove collected material.

14. A device for collecting material from a surface, the device comprising

a housing for receiving collected material,

a jaw arrangement which is configured to open to provide a mouth for receiving the material and to close to collect the material, said jaw arrangement comprising an opposed pair of pivotally movable jaws and a mechanism for moving both jaws simultaneously in opposite rotational directions, and

a conveyor mechanism comprising at least one heft or chain which is operable when the jaw arrangement is closed to advance a liner, placed over the jaw arrangement to separate it from the material being collected, so that in use the jaw arrangement is operable to be closed around the material to be collected and then the conveyor mechanism is operable to advance the liner and the material collected in it through the mouth and into the housing, the collected material being retained in the liner without making contact with surfaces of the device.

15. A device for collecting material from a surface, the device comprising

a housing for receiving collected material,

a jaw arrangement which is configured to open to provide a mouth for receiving the material and to close to collect the material, and

a conveyor mechanism which is adapted to advance a predetermined distance each time it is operated, said conveyer mechanism comprising at least one pair of belts or chains carrying at least one paddle for collecting material, said pair of belts or chains being separated from one another and linked by the paddle,

said conveyor mechanism being, operable when the jaw arrangement is closed to advance a liner placed over the jaw arrangement to separate it from the material being collected, so that in use the jaw arrangement is operable to be closed around the material to be collected and then the conveyor mechanism is operable to advance the liner and the material collected in it through the mouth and into the housing, the collected material being retained in the liner without making contact with surfaces of the device.

16. A device for collecting material from a surface, the device comprising

a housing for receiving, collected material,

a jaw arrangement which is configured to open to provide a mouth for receiving the material and to close to collect the material, and

a conveyor mechanism comprising at least two belts or chains, each carrying a plurality of paddles positioned to contact one another upon closure of the jaw arrangement to collect material, said conveyor mechanism being operable when the jaw arrangement is closed to advance a liner placed over the jaw arrangement to separate it from the material being collected, so that in use the jaw arrangement is operable to be closed around the material to be collected and then the conveyor mechanism is operable to advance the liner and the material collected in it through the mouth and into the housing, the collected material being retained in the liner without making contact with surfaces of the device.

17. A device for collecting material from a surface, the device comprising

a housing for receiving collected material,

a jaw arrangement that is carried upon a sliding assembly within the housing and retractable into the housing, jaw arrangement being configured to open to provide a mouth for receiving the material and to close to collect the material, and

a conveyor mechanism comprising at least one belt or chain which is operable when the jaw arrangement is closed to advance a liner, placed over the jaw arrangement to separate it from the material being collected, so that in use the jaw arrangement is operable to be closed around the material to be collected and then the conveyor mechanism is operable to advance the liner and the material collected in it through the mouth and into the housing, the collected material being retained in the liner without making contact with surfaces of the device.

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